

CLAIMS

What is claimed is:

- Sub
A¹ 5
1. A head-related transfer function model for use with 3D sound applications, comprising:
- a plurality of Eigen filters;
 - a plurality of spatial characteristic functions are adaptively combined with said plurality of Eigen filters; and
 - a plurality of regularizing models adapted to regularize said
- 10 plurality of spatial characteristic functions prior to said respective combination with said plurality of Eigen filters.
2. The head-related transfer function model for use with 3D sound applications according to claim 1, further comprising:
- 15 a summer operably coupled to said plurality of combined Eigen filters combined with said plurality of regularized spatial characteristic functions to provide said head-related transfer function model.
- 20 3. The head-related transfer function model for use with 3D sound applications according to claim 1, wherein:
- said plurality of regularizing models are each adapted to perform a generalized spline model.
- 25 4. The head-related transfer function model for use with 3D sound applications according to claim 1, further comprising:
- a smoothness control operably coupled with said plurality of regularizing models to allow control of a trade-off between localization and smoothness of said head-related transfer function.

5. A head-related impulse response model for use with 3D sound applications, comprising:

a plurality of Eigen filters;

a plurality of spatial characteristic functions are adapted to

5 be respectively combined with said plurality of Eigen filters; and

a plurality of regularizing models adapted to regularize said plurality of spatial characteristic functions prior to said respective combination with said plurality of Eigen filters.

10 6. The head-related impulse response model for use with 3D sound applications according to claim 5, further comprising:

a summer adapted to sum said plurality of combined Eigen filters combined with said plurality of regularized spatial characteristic functions to provide said head-related impulse response model.

15 7. The head-related impulse response model for use with 3D sound applications according to claim 5, wherein:

said plurality of regularizing models are each adapted to perform a generalized spline model.

20 8. The head-related transfer function model for use with 3D sound applications according to claim 5, further comprising:

a smoothness control in communication with said plurality of regularizing models to allow control of a trade-off between localization and smoothness of said head-related transfer function.

A1
Cand

9. A method of determining spatial characteristic sets for use in a head-related transfer function model, comprising:
 - constructing a covariance data matrix of a plurality of measured head-related transfer functions;
 - 5 performing an Eigen decomposition of said covariance data matrix to provide a plurality of Eigen vectors;
 - determining at least one principal Eigen vector from said plurality of Eigen vectors; and
 - projecting said measured head-related transfer functions
 - 10 back to said at least one principal Eigen vector to create said spatial characteristic sets.
10. A method of determining spatial characteristic sets for use in a head-related impulse response model, comprising:
 - 15 constructing a covariance data matrix of a plurality of measured head-related impulse responses;
 - performing an Eigen decomposition of said covariance data matrix to provide a plurality of Eigen vectors;
 - determining at least one principal Eigen vector from said
 - 20 plurality of Eigen vectors; and
 - back-projecting said measured head-related impulse responses to said at least one principal Eigen vector to create said spatial characteristic sets.

SECRET 20250616

A1
amb

5
20
25

- 11. Apparatus for determining spatial characteristic sets for use in a head-related transfer function model, comprising:
 - means for constructing a covariance data matrix of a plurality of measured head-related transfer functions;
 - means for performing an Eigen decomposition of said covariance data matrix to provide a plurality of Eigen vectors;
 - means for determining at least one principal Eigen vector from said plurality of Eigen vectors; and
 - means for back-projecting said measured head-related transfer functions to said at least one principal Eigen vector to create said spatial characteristic sets.

- 12. Apparatus for determining spatial characteristic sets for use in a head-related impulse response model, comprising:
 - means for constructing a covariance data matrix of a plurality of measured head-related impulse responses;
 - means for performing an Eigen decomposition of said covariance data matrix to provide a plurality of Eigen vectors;
 - means for determining at least one principal Eigen vector from said plurality of Eigen vectors; and
 - means for back-projecting said measured head-related impulse responses to said at least one principal Eigen vector to create said spatial characteristic sets.